palæ transformed into perfect vegetative leaves of the flowers situated higher up, all the flowering organs have generally disappeared without leaving a trace behind them.

XXVI.—*Botanical Notices from Spain.* By Moritz Willkomm*.

No. I. Valencia, middle of May 1844.

On the first days of my stay in Valencia, where I arrived on the 5th of May, my operations were confined to making acquaintance with the scientific institutions and the surrounding neighbourhood of the town. I was the more invited to do this, since the continued rainy weather offered an obstacle to longer excursions. Indeed the Valencians themselves could scarcely remember it to have rained so abundantly and uninterruptedly, and this weather was even a subject of public discussion in the newspapers. The temperature was almost to be called cool; since at this time of year the mean daily temperature is usually 20° C., and it amounted then barely to 15°—17° C. One of my first walks was to the Botanical Garden by the Puerta de Cuarte: into this you enter through a rather insignificant building in which the lectures on botany and agriculture are delivered. The garden, laid out in a magnificent style, occupies a very large space, and considering the glorious climate and the uncommon fertility of the soil, might, under the direction of an able man, become one of the most important gardens in Europe, if the government would do something for its maintenance. It has it is true the appearance of a botanical garden, since one sees many rows of labels, but the plants are wanting. What plants there are, are the remnant of those placed there through Cavanilles, and exotic shrubs and trees of a still earlier date. The fault of this lamentable decline of so well-arranged an institution is partly to be laid to the deficiency of interest on the part of the government in all that relates to science, partly and chiefly to the want of a well-informed director. Considering how luxuriantly everything grows up in this happy land in a few years, without any care, much might be accomplished with very little money. Of plant-houses there is no trace; they are indeed superfluous, since a great number of tropical plants may be cultivated very well here in the open ground; at the utmost only a green-house would be necessary in the short winter. The present director of the garden is named Don José Pezcuerda, so far as I may judge, a tolerably ignorant man, whose whole knowledge of literature is confined to little more than the works of Linnæus, Cavanilles, Clemente, Lagasca, Buffon and DeCandolle. Of Germany he knew almost nothing; neither does he possess a herbarium. Nevertheless the garden is in somewhat better condition in his hands than under the direction of his predecessor, the present Cathedratico of agriculture, Don Joaquin Carrascosa, formerly Archdeacon in Alicant. Although

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Don Antonio Blanco, the occupant of the post before him, a younger but very well-informed man who had prosecuted his studies partly in Paris, had begun to arrange the plants according to DeCandolle, Carrascosa re-introduced the sexual system, which Pezcuerda has retained, and has here displayed his ignorance in the grossest blunders against system, since, for instance, he arranges *Leguminosæ* in the nineteenth, *Cruciferæ* in the sixth class, &c. At last, as Carrascosa had suffered two show-plants of the garden, a very large old specimen of *Sophora japonica* and another of *Parkinsonia aculeata*, to be cut down —he having taken them for mulberry-trees (!), it was too outrageous, and Carrascosa was removed from the directory of the garden. The directory was taken from Prof. Blanco last year on political grounds, which is much to be lamented. Of the present condition of the garden, little can be said. The interior is divided into regular compartments, surrounded by orange-hedges; these are sufficiently watered by means of stone water-courses, and separated from each other by an elegant trellis-work of Spanish cane. Each plant, or place where once one has been, is furnished with a label of fire-glazed white clay, on which the number stands, but no name. The names of the classes and orders of the sexual system are marked on larger labels in the Spanish language. There is a special quarter for water-plants, where however I saw only *Canna indica* and one other apparently determined as a fern, but which was only *Pteris aquilina* cultivated. Enormous cypresses, great trees of *Cassia corymbosa*, *Pistacia Terebinthus*, *Acacia Farnesiana*, *Bignonia Catalpa*, *Melia Azedarach*, *Schinus molle*, shrubs of arborescent *Malvaceæ*, of *Solanum Bonariense*, *Bignonia radicans* and other exotic vegetables, ornamented the borders of the garden,—remnants of former splendour! Especially worthy of mention are a beautiful date-palm, and, particularly, an old specimen of *Chamærops humilis* with a stem 10 feet high, as also a showy *Yucca gloriosa* with a stem about 6 feet high and nearly 1 foot thick, which were just in full bloom.

More directly interesting is the rural or agricultural garden, which is situated behind the botanical garden, and was established six years ago. Its present director is the already often-mentioned Carrascosa, to whom however the credit of having established the garden is not due. Although it has only been laid out six years, there are transplanted into it trees and shrubs already so large, that one would take the garden to be much older,—an evidence of the luxuriant fertility of the soil. The garden is divided into twelve compartments. Two of these are designed for officinal plants, and surrounded by a hedge of *Cactus Opuntia*, L. (sp. Nopal). Here are collected the dye-plants, which are arranged according to the different colours, the plants which yield soda and potash, as also those used in the manufacture of textile fabrics. Under the latter the celebrated Esparto (*Macrochloa tenacissima*, Kth.) is especially to be mentioned, which, growing on many of the hills situated near the sea, forms a not unimportant article of trade in South Spain, since this tough grass is used partly for the plaiting of coverings for rooms and balconies, and for making various sorts of baskets, especially

panniers for mules, chairs, and the peculiar sandals which are worn all over the kingdom; and partly worked into ropes which are in great request, and for instance, are manufactured in great quantity in Marseilles. In two other quarters of the garden, 400 varieties of apple- and pear-trees are in cultivation, chiefly brought over from North America; also in another, a collection of 95 varieties of apricots, peaches and the like. In one division, surrounded by 36 varieties of almond-trees, are 308 kinds of Spanish vines, which are arranged according to the classical work of Don Roxas Clemente (*Ensayo sobre la vin comun*). Other quarters are designed for the fodder-plants, for trees and shrubs, which are to be used partly for planting forests, partly for gardens and parks. The back part of the garden is closed in by a very long hedge of *Agave americana*, L. (sp. Pita), behind which stand the collected varieties of olives and algarrobas (*Ceratonia Siliqua*, L.). The first ground for this garden was laid out in the year 1835; however the money was insufficient to the purchase of the required area, which was first accomplished in the year 1839. There is here a theatre for the lectures on agriculture, also a collection of instruments and models. The chair of agriculture was established by royal command in the year 1834. Since that time nothing more has been done by the government for natural science in the university of Valencia, although this is among the most frequented of the Spanish universities, since it numbers at present 1800 so-called students and some 60 professors.

The immediate neighbourhood of the city, known and famous as the Huerta de Valencia, is very astonishing to every foreigner. The fertile plain watered by the Rio Turia (in the midst of which lies the city about a mile distant from the sea), is, in a circuit of from three to five miles round, converted by the indefatigable activity of the Valencians into a garden verdant throughout the whole year. Innumerable water-courses traverse the Huerta, and numerous water-wheels conduct this element, so precious in Spain, into all the fields and gardens. The culture of wheat forms the chief branch of agriculture; besides which, a particularly large quantity of hemp, and westward of Valencia, toward the lake of Albufera, a great deal of rice is also grown. The fields are surrounded with rows of mulberry-trees, and in the east and north the Huerta presents extended plantations of olives, which are here much larger and more beautiful than the dwarf shrub-like olive-trees of Provence. It has also many fig, citron and orange trees, especially in the neighbourhood of the country-houses, while the roads and streets are ornamented with rows of elms, *Populus canescens*, *nigra* and *monilifera*. The date-palm is rather a rare object, although it attains here a height of as much as 40 to 60 feet. They are seen most abundantly in the gardens and courts of the numerous monasteries in and around Valencia. For instance, I have seen in the court of the monastery of San Miguel de los Reyes twelve, in that of the Cartucha Ara Christi, not far from Murviedro, about thirty high-stemmed palms. The private estates in the Huerta are mostly surrounded with a hedge of *Arundo Donax*, L., which in damp places in the warm region grows wild everywhere, or of *Tamarix gal-*

lica, L., in the neighbourhood of the sea, as well as of *Agave americana* and *Cactus Opuntia*. The last is also cultivated in many gardens for the sake of the cochenille, although it occurs everywhere wild on stony, sunny places in the warm sea-region; for instance, the whole south and east slopes of the castle of Murviedro are covered with impenetrable bushes of a man's height, in which stems of 4 or 5 inches diameter are frequently seen. Of herbaceous vegetables are grown in the Huerta very many strawberries, artichokes, onions, garlic, beans, peas, *Vicia Faba*, L., and especially the Garbanzos (*Cicer arietinum*, L.), so much loved by the Spaniards. The water-courses are almost universally decked with *Iris Pseudacorus*, and filled with our species of *Lemna* and *Potamogeton*. A pretty red-flowered *Silene* is not uncommon, and on the walls *Hyoscyamus alba* grows everywhere in luxuriant abundance, while the hedges are overrun with *Fumaria capreolata*, L., and *Rubiaceæ*. All sandy places, particularly the shore of the Rio Turia, are covered with *Plantago Coronopus*, L., *Calendula officinalis*, Erodias and Euphorbias.

As soon as the weather permitted, I made an excursion to the lake of Albufera, which is situated about two leagues westward of Valencia, and is connected with the sea by a narrow canal. Almost the whole of its shores are covered with rice-fields, yet the strip of land, about three-quarters of a mile broad, which separates it from the sea and which is little else than a mound of sand, is occupied by a wood of *Pinus Halepensis*, Mill. This little wood is one of the spots richest in plants in the neighbourhood of Valencia, on which account I have often visited it. The ground is covered with a low underwood which is chiefly composed of *Quercus coccifera*, *Myrtus communis* and *Chamærops humilis*; beneath these frequently occur bushes of *Juniperus Oxycedrus*, L., *Rhamnus Lycioides*, L., *Erica arborea*, L., *Rosmarinus officinalis*, L., *Ruscus aculeatus*, L., *Pistacia lentiscus*, L., &c. On the shore of the Albufera in loose quicksands are pretty frequently found great bushes of *Solanum Sodomæum*, L., with stems as thick as a man's arm, and *Trixago Apula*, Col., *β. versicolor*, *Lagurus ovatus*, L., &c. clothe the more grassy places. In the interior of the wood occur many *Helianthema*, *Coronilla juncea*, L., *Urospermum picroides*, Desf., and frequently *Elæoselinum fœtidum*, Boiss., which however was not yet in fruit. In the thick bush grows very rarely *Lonicera implexa*, Ait., and in the neighbourhood of the coast the beautiful *Iris filifolia*, Boiss., but also very sparingly. The numerous shallow lagoons which occur between the Albufera and the sea are filled with Charas and Potamogetons; these also cover the bottom of the Albufera, and *Juncus acutus*, L., the margin. The grassy sand-hills in front of the pine-wood are covered over and over with *Cistus albidus*, L., and *C. salvifolius*, L., while the bare sand-downs near the sea are overgrown with *Asphodelus fistulosus*, L., Euphorbias, and *Passerina hirsuta*, L. In the neighbourhood of the sea *Ononis Natrix* is pretty well scattered, and a silky-haired *Lotus*. In the Albufera also the *Vallisneria spiralis* presents itself, which Cavanilles, and, quite lately, Blanco have found here; I however have

not met with it, although I have often taken a boat on the lake on purpose to look for it.

No. II. Valencia, end of May 1844.

Sierra de Chiva.

The Sierra de Chiva, so called from the market-town of Chiva, situated four leagues north of Valencia, like all the mountains of the kingdom of Valencia, belongs to the limestone formation, and indeed is chiefly composed of Muschelkalk. It consists of a number of parallel mountain ridges extending from west to east, which are divided by deep cross-valleys (in Spain called Barrancos); it is of very considerable breadth, and rises gradually to a height of 6000 feet from the great plain, which is bounded eastward by the Sierra de Murviedro, westward by the Sierra de Cullera and other mountains, and is traversed by the Rio Turia. This thinly inhabited, but very romantic mountain district was, it is said, in former times covered with dense pine-forests, of which remain only isolated trees of *Pinus Halepensis*, Mill., and another species of Conifer called by the people *Pino Roveno*, which however is said to be very rare (I have only seen one low shrub of it). At present the whole of this mountainous region is entirely bare, or only covered by a low underwood, which at different heights is composed of different species of plants. The highest peaks want even this, and especially on the north and east aspects, where the moist cliffs are clothed with grasses and herbaceous vegetables. True meadows however are wholly absent here. The whole mountain tract is uncommonly dry; even in the valleys we find a little brook but rarely; although there is no want of springs on the declivities, their water wholly evaporates before it can reach the bottom of the valleys. The cause of this is, the very elevated temperature produced by the reflexion of the sun's rays from the white limestone rocks which form the walls of the valleys. Hence the vegetation in the valleys is far more scanty than on the slopes of the higher mountains; and even where a brook runs through the valley, the banks are overspread with a broad deposit of sand and pebbles, devoid of vegetation, which makes its first appearance at the foot of the slope bordering the valley. From the investigations of the condition of vegetation which I was enabled to make during my fortnight's sojourn in this mountain district, I am inclined to admit the five following regions in the Sierra de Chiva, which may perhaps be applicable to the other mountains of the province of Valencia; I will endeavour to describe their vegetation as briefly as possible.

1. *Lower warm region*, to a height of about 500 feet, characterized by the culture of *Ceratonia Siliqua*, L., and the presence of *Agave americana*, L., and *Cactus Opuntia*, L.—To this region belong the immediate environs of Chiva, Cheste and Buñol, as also the plains and outlets of the valleys at the foot of the Sierra. Besides the already-mentioned St. John's bread-tree, olive, fig, and mulberry trees are universally cultivated, also wheat, hemp, maize, and in hilly

places, vines. The streamlets coming from the Sierra and many other springs water this soil, in itself fertile (and, as may be conjectured from its general red colour, containing much oxide of iron), calling forth a tolerably rich vegetation, which however contains no rarities. The sandy places on the roads and under plantations are overspread with the splendid *Convolvulus althæoides*, L., which of itself is quite characteristic of this region; the vine-hills with *Anchusa italica*, L., *Cynoglossum cheirifolium*, L., *Psoralea bituminosa*, L., *Gladiolus segetum*, Gawl., *Mercurialis tomentosa*, L., *Helianthema*, *Silenes*, *Salviæ* and *Cichoraceæ*. I observed here also a flesh-coloured *Orobanche*, which however appears more abundant in the higher regions. Among the corn, *Arthrolobium ebracteatum*, DC., occurs plentifully in company with *Scorpiurus vermiculata*, L., *Hypecoum procumbens*, L., *Papaver Rhœas*, L., and a *Bupleurum*. On shady, moist walls, *Telephium Imperati*, L., is not uncommon, with other *Crassulaceæ*, and *Adiantum Capillus-Veneris*, L., thrives everywhere in the crevices. Under luxuriant hedges of *Rubus fruticosus*, *Rosa canina*, *Lonicera Caprifolium*, *Punica Granatum*, L., *Pistacia Lentiscus*, L., *Myrtus communis*, &c., are found *Vinca media*, L., *Hyoscyamus albus*, L., *Smilax aspera*, L., and other plants, matted together with *Rubiaceæ* and *Fumaria capreolata*, and overgrown with *Arundo Donax* and *Agave americana*, which in many places had already shot up a flower-stem from 6 to 8 feet high. I also found pretty abundantly in such shady hedges an *Antirrhinum*, which appears to be different from *A. majus* and *molle*, since it has very slender, linear, channeled leaves, and a very long, almost twining stem; it must therefore be the variety *angustifolium* of *molle*, discovered by Boissier in Granada. The banks of the streamlets are densely covered with thick bushes of *Myrtus communis*, *Nerium Oleander*, *Ficus Carica*, L., &c.; while the hillocks are clothed with *Chamærops humilis*, L., *Erica arborea*, L., *Daphne Gnidium*, L., *Retama sphærocarpa*, Boiss., various dwarf oaks, *Ulex australis*, L., and *Rosmarinus officinalis*, L.

2. *Upper warm region*, from 500 to 2000 feet high, to the limit of *Chamærops humilis*.—Of cultivated plants, olives, wheat, and especially the vine, are universally grown. To this region belong the calcareous uplands of the Sierra as well as the lower part of the mountains. The soil is far less fertile, mostly very dry (as there are few or no springs in this region), and clothed with low bushes, chiefly composed of *Rosmarinus officinalis* and *Chamærops humilis*, and under these *Rhamnus lycioides*, L., *Juniperus Oxycedrus*, L., *Retama sphærocarpa*, Boiss., *Pistacia Terebinthus*, L., *Erica arborea*, L., *Linum fruticosum*, L., *Cisti* and *Helianthema*. Of herbaceous plants occur everywhere here, *Stipa juncea*, Ait., *Macrochloa tenacissima*, Kunth (not yet in flower), the above-mentioned *Orobanche* plentifully, *Biscutella saxatilis*, Boiss., γ. *angustifolia* (*B. lævigata*, L., var.), a *Lavandula*, *Linum*, *Leguminosæ* and *Cruciferæ*. On some places (castle near Chiva, Barranco de Ballestero) I found *Digitalis obscura*, L., and on very sunny slopes under bushes *Dictamnus Fraxinella*, Pers., *Ruta montana*, L., and a *Passerina*, but all three very sparingly; while

in the valleys in moist shady spots *Cerinthe major*, L., many *Lathyri*, a *Nigella*, *Bellis*, &c. occur abundantly.

3. *Lower mountain region*, from about 2000 to 4000 feet high, to the limit of the cultivation of olives and wheat.—Only on the declivities of the mountains, in the vicinity of the here tolerably numerous springs, are tracts of cultivated land now found, belonging to retired country-houses; all else is untilled mountain land. To this region belong the upper part of all valleys, the lower peaks of the Sierra, and the wide, waste table-land that stretches between the mountain ridges. The 'Monte bajo,' as the so-often-described dwarf underwood is called in Spain, is here composed of pretty much the same plants as in the preceding region, except that here appear the first fir-bushes and shrubs of *Juniperus phœnicea*, L. (here called *Sabina*), while *Juniperus Oxycedrus*, *Pistacia Lentiscus*, *Retama sphærocarpa* and *Chamærops humilis* are no longer to be met with. In this region occur not unfrequently shrubs of *Fraxinus excelsior*, L., *Arbutus Unedo*, L., many oaks, especially a peculiar form of *Quercus Ilex*, L. Many *Labiatæ*, the already-mentioned *Lavandula* with *L. Spica*, L., a golden-yellow *Teucrium*, *Thymi*, *Marrubium sericeum*, Boiss.?, numerous *Leguminosæ*, especially at a height of 3000 to 4000 feet, a blue-flowered prickly *Astragalus*, species of *Ononis* and *Hippocrepis*, also *Convolvulus saxatilis*, Vahl., *Silenes*, *Centaureæ*, and on the higher slopes *Orchis mascula*, L., and *Asphodelus ramosus*, L. (which here first began to flower), grow under and among these shrubs. In the neighbourhood of the springs, on damp declivities, occur also meadow-like grassy places, chiefly made up of *Ægilops triuncialis*, L., and species of *Medicago* and *Lotus*, which however offer no remarkable vegetation.

4. *Upper mountain region*, from about 4000 to 5500 feet.—To this are to be referred the higher peaks of the Sierra, as la Casoleta, el Cerro la Grana, Pico de Pascual, Monte de los Ajos, &c., which are void of all culture. Isolated firs, and a 'Monte bajo' chiefly composed of *Ulex australis* and *Juniperus phœnicea*, L., characterize this region, in which however solitary springs are still met with. Of herbaceous plants occur, particularly, a *Jasione* (perhaps *foliosa*, Cavan.?), an almost shrubby flesh-coloured *Anthyllis*, *Iberis nana*, All.?; on the declivities *Salvia officinalis*, L., *Orchis mascula*, L., and an *Ophrys*; and on very rocky places, a *Bunium* with tubers very deeply implanted in the crevices. About the springs I observed *Nasturtium officinale*, as it is chiefly in this region that many of our commonest plants appear, ex. gr. *Malva sylvestris*, *Euphorbia Helioscopia*, *Lamium amplexicaule*, *Capsella Bursa-pastoris*, *Papaver Argemone*, &c.

5. *Alpine region*.—This includes in the Sierra de Chiva only the upper part of the highest mountain, called Monte de la Santa Maria. On the very steep and damp eastern slope of this mountain, I found of woody plants chiefly *Arctostaphylos Uva-ursi*, Adans., not yet in flower, and *Taxus baccata*, L., abundantly, more rarely a *Cotoneaster*. A proper 'Monte bajo' is wholly wanting here. A *Saxifraga* thrives in luxuriant tufts on the damp mould at the foot and in the

crevices of the limestone cliffs which encompass the summit, as also on the steep slopes, which were, besides, covered with *Asphodelus ramosus*, L., the before-mentioned *Iberis* and *Anthyllis*. Here too occurred, although but very few specimens, in the region of the Saxifrages, a pretty *Tulipa*, which appears to be new, since it differs from *T. Celsiana*, which it resembles in the colour of its flower, by "*foliis reflexis, flore nutante (nec erecto) et perigonii segmentis lanceolatis (nec oblongo-lanceolatis)*," setting aside the difference of habitat, since *T. Celsiana* only presents itself in the warm region. Lastly, on the highest rocks of Sta Maria flourish *Muscari botryoides*, and especially *Armeria alliacea*, W., in great abundance.

The very small number of Cryptogamia, even in the mountain and alpine regions, is striking. The bark even of the older trees is generally quite bare, or at the most covered with a layer of *Parmelia parietina*; the rocks also are for the greater part devoid of all Lichens. In the springs a *Chara* is found, yet no Algæ, and of mosses and ferns, very few occur in the upper mountain and alpine region. Of ferns I have observed, on the rocks of Sta Maria, only *Ceterach officinarum*, *Asplenium Trichomanes* and *A. fontanum*; of mosses, besides some barren *Hypna*, only an *Encalypta* and *Frullania hispanica*, N. ab Es.; the latter indeed, like the liverworts of our mountains, in thick tufts. The cryptogamic flora is said to be more considerable in winter.

BIBLIOGRAPHICAL NOTICES.

Die Kieselschaligen Bacillarien oder Diatomeen. Von Dr. F. T. Kützing: Nordhausen, 1844. Tab. 30. p. 152.

The beauty and correctness of the plates in the 'Phycologia Generalis,' which we have already reviewed in our Journal, has excited the admiration of all who have noticed or consulted the work. Those of the present are equally deserving of praise, and maintain the reputation of the author as an excellent draughtsman and accurate observer. A certain proportion of the figures are professedly copies, but wherever the author has been able to prepare the illustrations himself he has not failed to do so, and the instances to the contrary are not so numerous as to detract from the originality of the work. Dr. Kützing, to whose kindness we are indebted for our copy, has profited by all the materials which came within his notice, and if we mistake not also by the criticisms to which his former work was subjected, not indeed as regards the illustrations but in respect of its plan, and especially of his notions of genera and species. In the present instance the species are all defined, the principal synonyms noticed, and some details given under each generic head, in all which points the 'Phycologia' was very deficient. It is we understand his intention to publish the *Desmidiaceæ* in a similar form, and we do not doubt that we shall find the same progressive improvement which we so gladly hail in the present instance. He will we know be most grateful to those who have studied this curious and